DOCUMENT RESUME

ED 281 232 CS 210 461

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TITLE The Effect of Word Processing on the Revision of Basic Writers.
PUB DATE Mar 87
NOTE 25p.; Paper presented at the Annual Meeting of the Conference on College Composition and Communication (38th, Atlanta, GA, March 19-21, 1987).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; Higher Education; *Revision (Written Composition); Teaching Methods; *Word Processing; *Writing Improvement; Writing Instruction; *Writing Laboratories; Writing Processes; Writing Research
IDENTIFIERS *Basic Writing

ABSTRACT

To determine whether basic writers revise more successfully using word processors as opposed to pen and paper, a study investigated the quality of revision of approximately 100 college basic writers in three classes at a southern university. In the fall semester, word processors were used in each of the three classes once every two weeks. In the spring semester, the three classes were split into two experimental groups (one used word processors twice a week in class, the other used them once a week outside of class) and one control group that did not use word processors at all. The first and final drafts of an assigned narrative paragraph were evaluated for all groups in both semesters. Comparisons of results from the fall semester indicated no significant differences in the quality of the three groups' revisions. For the spring semester, however, the experimental groups demonstrated a significantly higher quality of revision than did the control group. Revising on the word processor in a writing laboratory outside of class was found to produce the most significant effect on the overall quality of revision. This finding can be attributed to several possible factors--student attitude, environmental influence, and the difference in the revision process as it occurs when using the word processor. (Three pages of references are included.) (JD)

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The Effect of Word Processing on the Revision of Basic Writers

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Abstract

This study investigated the effects of word processing on the quality of revision of approximately 100 college basic writers. Three teachers' fall and spring classes were examined. In the fall semester, all three teachers operated under comparable conditions (using computers in class once every two weeks). In the spring semester, however, these three teachers' classes were divided into two experimental groups which used computers and one control group which did not. The first and final drafts of an assigned narrative paragraph for all six groups were judged by trained raters blind to experimental conditions. A set of planned comparisons was conducted which revealed no significant difference in the three groups' quality of revisions in the fall and a significant difference in the quality of revisions between the experimental and control groups in the spring. The results indicated that word processing does have a positive effect on the quality of revision in basic writers.

The Effect of Word Processing on the Revision of Basic Writers

The purpose of this experimental study was to discover whether basic writers revised more successfully with a word processor than with pen and paper. Relatively little of the research conducted on the effect of the word processor on revision has involved the basic writer or the issue of overall quality of revisions. Most of the research has involved very young writers or able writers (either professionals or successful college writers). Moreover, that research has focused mostly on attitudes and kinds of revision rather than on quality of revision.

Young Writers

The majority of qualitative studies has involved young writers--often of junior high and elementary school age. Though several studies have reported that the word processor has no effect on the quality of younger students' writing, other studies have shown the word processor producing better quality writing than the pen.

Butler-Nalin (1985) and Duling (1985) found the word processor had little or no effect on the quality of junior high school students' revisions. Likewise, Piper (1984) and Miller (1984) in separate studies involving middle school students found no significant differences in writing skills between groups using pen and word processor to combine sentences and write paragraphs. However, Pivarnick (1985) indicated that students trained in word processing had a significantly higher mean writing score than a control group using

pen and paper. Likewise, Koenig (1984) found that middle school students using the word processor performed significantly better than control groups on meaning and usage.

The most often quoted and significant studies on children using the word processor have been conducted by Colette Daiute. Daiute and Taylor (1981) found that eight children composing with a word processing program for five weeks made more revisions per word, more kinds of revisions, and wrote papers with fewer errors and higher holistic scores in post tests than those who used pen and paper. In a longer study conducted five years later, Daiute (1986) again seemed to find that computers improved the overall quality of revisions more than did the pen. Using 57 junior high students in a year long study, Daiute found that students using the computer wrote more but in fact made fewer revisions than those who used pen. Moreover, most of the revising which the word processing students did was additive, and the additions for the most part were tacked onto the end of texts where they usually did not fit. Although Daiute reported that the quality of the computer-written pieces was judged superior to the handwritten pieces by trained evaluators, she admitted that her quality findings might be flawed because her evaluators consistently gave higher grades to longer texts.

Able Writers

While research on able writers contains little information on improvement of overall quality, when the issue of quality has arisen, researchers have found little evidence that the word processor improves the overall quality of revisions.

In general, studies have found that able writers using the word processor make different kinds and amounts of revision than those using pen. Most research has skirted the issue of overall quality and concentrated on cataloguing the kinds of revisions made on the word processor. Using Faigley and Witte's (1981) concepts of "surface" and "meaning" changes to describe two levels of revision, researchers have found that able writers tend to make more "surface" or minor changes when they use the word processor, but little evidence has been found to indicate that able writers make more of the important "meaning changes" when they use the word processor.

While studies focusing on professional writers (Gould, 1981; Haas & Hayes, 1986) have produced contradictory findings, studies using able college writers have generally found that word processing does not improve the overall quality of revisions more than does the pen. Richard Collier (1983), in an early informal study, concluded that for his class of four college students, "the use of the word processor for revising purposes did not enhance the quality of their written products" (p. 153). Three other studies between 1983 and 1985 (Balkena, 1984; Pollock, 1985; Greenland, 1985) drew similar conclusions. Then, in an informal report on six able writers, Jeanette Harris (1985) concluded that "using a word processor seems to discourage revision" (p. 330).

Gail Hawisher (1986) reported studying 20 able students over one semester and concluded that the word processor did not produce more revisions nor better revisions than pen and typewriter. To our knowledge, Hawisher's is the most recent and conclusive study on the

effects of word processing on revision, and it should be noted that her findings seem to contradict our own. However, Hawisher's findings must be examined closely.

First of all, her study involves "able" success-oriented students writing long essays, and not basic writers composing paragraphs. As both Daiute and Hawisher have noted, a writer's ability may determine how effectively word processing will be used: it is quite possible that what could cause dramatic improvements in basic writers could have little if any effect on able writers.

Secondly, all of Hawisher's students learned how to use a word processor, and as Hawisher herself suggests, those essays written in pen may well have been influenced by skills developed earlier in the semester when these students used the word processor. In fact, the control group's transfer of word processing skills into handwritten essays seems likely. Thus, an independent variable in Hawisher's report--that both pen and word processing students learned how to revise on a word processor--seems to undercut her findings.

Third, all students were made to turn in three drafts of each essay. In other words, both pen and word processing students were made to do a similar amount of revision. Such a constraint could cause both groups to do both a relatively similar amount and quality of revision, which was what Hawisher in fact found.

Finally, although Hawisher claims that the quality of revisions on the word processor were not significantly better than those in pen and typewriter, her tables compare only the final drafts of papers. Visible in her report are no comparisons of the difference in quality

between original drafts and revisions for experimental and control groups. Such a comparison is the focus of our own study.

Because Hawisher's study involves able college students and long essays, it is substantially different from our own. Although she suggests that the word processor does not seem to produce better revisions than handwriting, the design of her study raises questions about her conclusions and sets the stage for further research.

Basic Writers

Only two reports on basic writers using the word processor have come to our attention, but neither has contained definitive conclusions on the overall quality of revisions on the computer versus revisions by pen. Nichols (1984) noted that basic writers using the computer reduced the number of second physical drafts, had shorter work sessions, and edited more frequently. Rodrigues (1985), in an informal, non-statistical study, noted a definite attitude improvement in basic writers who used the word processor, but could not report any substantive change in quality of writing caused by the word processor.

Summary

Past research on the effects of the word processor on revision has varied widely in method, purpose, and conclusion. Many of the studies have been highly informal, lacking statistical evidence, or have involved small numbers of subjects and small numbers of texts over relatively short periods of time. Most of the studies have investigated attitude or kinds of revisions, not the effect of the word processor on overall quality of revisions. Those few studies which have investigated the effects of the word processor on the quality of

revision have shown uncertainty or have disagreed with one another in their conclusions. For example, while Daiute reported significant positive effects on revision when the word processor was used with junior high school writers, Hawisher saw no significant positive effects on able writers. Clearly, the field of study remains open for further research--particularly research involving basic writers. We feel that our study provides crucial data on the effects of the word processor on the quality of basic writers' revisions.

Method

Subjects

Subjects were three teachers' fall and spring semester developmental English classes (ACT score of 14 or below), 102 students.

The number of students in each of the six classes was comparable: Teacher 1: fall, 16; spring, 19; Teacher 2: fall, 19; spring, 16; Teacher 3: fall, 16; spring, 16.

Design and Procedure

In the fall semester, all three teachers operated under the same experimental conditions. Their classes attended the electronic learning laboratory once every two weeks and worked on computer-assisted instructional drill and practice exercises as well as computer-assisted composition.

During the spring semester, however, these teachers' classes were divided into two experimental groups and one control group (Table 1). Both experimental groups 1 and 2 received a two-hour orientation to the Apple Writer word processing program in the beginning of the semester. Experimental Group 1 (teacher 1) attended the microcomputer writing

laboratory twice-a-week during class time (class met five times a week) with their instructor and a graduate assistant. This time was spent solely writing and revising their papers on Apple Writer. Experimental group 2 (Teacher 2) did not attend the laboratory during regular class meeting time, but instead attended once a week in addition to their regular class time. Here they performed supervised writing activities, e.g., keeping a journal, writing and revising paragraphs, etc. The control group (teacher 3) did not attend the laboratory at all.

Insert Table 1 about here

Approximately two-thirds through each semester, students were assigned a narrative paragraph. All three teachers graded and commented on these first drafts and turned them back to the students for revision one week later. Students were given one class period to complete the first draft and one class period to complete the revision, so the revision conditions were controlled.

All sets of paragraphs--six sets of first drafts and six sets of revisions--were retyped by a student worker. To maintain anonymity, students' names were replaced by subject numbers, and paragraphs were color-symbol coded to identify teacher, semester, draft and revision. All teachers' comments and grades were also deleted.

During registration week of the following semester, seven graduate students were trained as reliable holistic graders. Four training sessions were conducted to promote grading consistency. The raters' job was to rank a group of papers and to decide on their quality by

determining how one paragraph compared to others. Rubrics for the holistic scoring of a paper from a low of one to a high of four were generated during the training sessions and consisted of the following categories:

1. LOW
   a. no focus, development, nor details
   b. dominated by "Engfish" (ineffective, unnatural language)
   c. distractingly bad grammar
   d. provokes question "What's it about?"
   e. lacks control of language or sentence structure
2. NOT SO LOW
   a. attempts focus, though may be artificial, repetitive, or trite
   b. has a sense of example
   c. demonstrates some organization
   d. demonstrates some language control
   e. grammar still a problem
3. NOT SO HIGH
   a. focused
   b. develops point through examples
   c. shows noticeable command of language, e.g., transitions
   d. shows variety in sentence structure
   e. grammar non-obtrusive
4. HIGH
   a. tightly focused, but not necessarily perfect
   b. originality
   c. noticeable language control: mature sentences and grammar

d. sense of audience; distinct and sincere voice

e. memorable examples

After four training sessions, graders had achieved 76% exact agreement on the grades they assigned, and the remaining 24% showed a difference of only one scale point. (During the experiment itself when three graders evaluated each paper, two out of three graders agreed on the rank of each paragraph 87% of the time.)

Following the four training sessions, each first draft and revision of the assigned paragraph for all six groups was judged by these trained raters, blind to conditions under which papers were written, i.e., fall vs. spring, teacher 1 vs. teacher 2 vs. teacher 3, computer-assisted composition vs. non-computer-assisted composition, original vs. revision. Each version was graded independent of the other version and was evaluated by three different raters who assigned a score from one to four. The final score for each paper was the average of the three raters' scores.

A set of planned comparisons was used to analyze the data and answer the following questions:

1. During the fall semester, when all three groups used minimal computer-assisted composition, was there any significant difference in the quality of revision between teachers 1 and 2 (those two teachers who would use computer-assisted composition in the spring) and teacher 3 (the control who would not be using computer-assisted composition at all)?

2. Also during the fall semester, was there any difference in the quality of revision between teacher 1 (computer-assisted composition

twice-a-week, spring) and teacher 2 (computer-assisted composition once-a-week, spring)?

3. Was there a significant difference in the overall improvement of revision over original between the fall and spring grades?

4. Was there a significant difference between the experimental group using the computers twice a week (teacher 1) and the experimental group using them once a week (teacher 2)?

5. Was there greater improvement in the revisions over the original in the two classes using the word processor (teachers 1 and 2) than in the class not using computers at all (teacher 3)?

Results

Each original and revision was graded three times (once by each grader). A set of planned comparisons was conducted on the average of the three grades.

Comparison 1. The first comparison looked at the fall data and compared the improvement of the revision grades over the original grades for the two teachers whose classes would be using computer-assisted composition in the spring (teachers 1 and 2) with the teacher whose class would not use computer-assisted composition in the spring (teacher 3). The comparison was not significant. These results indicate that before teachers 1 and 2 were assigned to their experimental conditions in the spring (computer-assisted composition), there were no significant differences between their ability to improve students' writing and that of teacher 3, who would not be using computer-assisted composition at all.

Comparison 2. The second comparison also focused on the fall grades, comparing the improvement of the revision over original for teacher 1 (who in the spring would be assigned to the twice-a-week computer condition) vs. teacher 2 (who would be assigned to the once-a-week computer condition). Again, there was not a significant difference. The results of comparison 1 and comparison 2 assure us that when the teachers used comparable methods of teaching, there were no significant differences in their effectiveness in improving their students' writing.

Comparison 3. The final comparison contrasted the fall and spring grades with respect to improvement of revision over original. The comparison showed that overall spring improvement was significantly greater than fall improvement, F (1,96) = 5.165, $p < .025$.

Comparison 4. This comparison concerned the spring grades and compared the improvement of the revision over the original for the class that used computer-assisted composition twice a week (teacher 1) with the class that used it once a week (teacher 2). The comparison was nonsignificant.

Comparison 5. This comparison was made on grades obtained in the spring semester. Again as in comparison 1, the improvement of the revision grades over the original grades for the two teachers using computer-assisted composition was compared with the teacher whose class did not use computer-assisted composition. This contrast was significant, F (1,96) = 8.055, $p < .01$. Inspection of the means in Table 2 reveals that there was greater improvement of the revisions

over the originals in the two classes using computer-assisted composition than in the class not using computer-assisted composition.

Insert Table 2 about here

Discussion

Why the classes of Teachers 1 and 2 showed significant improvement of revisions over original drafts seems attributable to the one major variable in the experimental study--the use of the word processor. If the use of word processors to revise was the cause for the significant difference in the improvement of Teachers 1 and 2's revisions, why was it the cause? We propose four possible explanations.

1. Students enjoyed the use of the word processor, and this enjoyment improved their attitude toward writing and as a result, the quality of their writing.

Other researchers have reported that the use of the word processor has a positive effect on the attitude of writers. Flinn (1985) reports such an effect on sixth graders while Rodrigues (1985), Case (1985) and Catano (1985) report such an effect on basic writers, professors, and professional writers respectively. An attitude measure taken with the students in our study showed that the word processor did have a positive effect on our students' attitudes towards writing. Given the improvement in attitude, it does not seem unreasonable that the revision process and revised text might improve. Learning the word processor is an accomplishment for anyone, but especially for a basic

writer, whose educational experience can often seem to be a series of impossibly high hurdles. The confidence that a basic writer would acquire in mastering the word processor could have a large consequential effect upon that writer's work.

2. Students enjoyed the experience of being in a laboratory, and the unacademic nature of this experience influenced their work.

Such a notion is not as ridiculous as it first sounds. It is entirely possible that it was not the word processors themselves, but the experience of working in a new setting which influenced the students' work. Countless articles and books have been written on the importance of establishing the proper environment for learning in a writing classroom. A computer writing laboratory is a frenzy of activity, and such activity--especially within a community of writers--can be infectious and have profound effects upon learners. Also, as Ronald Sudol (1985) notes, the word processing workshop can foster the master/apprentice relationship between teacher and student and can build a writer's sense of discipline and freedom simultaneously (pp. 331-332). If the word processing laboratory's environment indeed fulfills this claim, it no doubt can alter a student's ability to revise.

3. The word processor makes revising easy and fluid.

There is little argument that the word processor makes "surface changes" easy. Because students can correct spelling errors and punctuation mistakes on the word processor without having to undergo the drudgery of recopying a text, they will often make changes on the

machine that they would not make with a pen. However, improvement in overall quality involves more than surface changes; it usually involves "meaning changes" as well. Making such major changes in thought, structure, and detail may not necessarily be easier on the word processor than with pen, especially when one considers that many major changes come to a writer only upon getting caught up in the drudgery of recopying text. Thus, although the word processor obviously makes some kinds of changes easy, it has not been shown that the word processor makes meaningful changes easy.

Still, the word processor does make revision a more "fluid" process than it is on paper. As Flower and Hayes (1981) have shown and others since have confirmed, revision is not a neat linear process, but a "recursive" cognitive process. That is, one may reread the beginning of a text while working on the end, or one may decide to rework the middle of a text because of a change made at the end. Under our controlled conditions, the writers using paper could not work as recursively while transcribing the final versions of their texts as could the writers using the word processor. If the writers using pen and paper were to make a change "out of order," it had to be before transcribing the final revision, for example, in the margin of the original draft. Otherwise, an "out of order" change would entail throwing away the developing revision and beginning anew. Students are typically unwilling to throw away a developing draft, especially when they are low on time.

However, on the word processor changes on the final draft were not

necessarily permanent nor sequential. Changes made on that original draft were fluid ones--they could be deleted as quickly as they were added. As a result, writers using the word processor could revise the last sentence of their text and see it, in clean type, in the context of the whole original paragraph. Such an opportunity was unavailable to the handwriting student who would have to write out the whole paragraph in order to see a change at the end in such a context. It seems plausible that the fluid nature of the revision process on the word processor and the way it allows writers to see changes in contexts impossible on the written page could have influenced the quality of revisions performed on the word processor.

4. The word processor gives the writer more perspective on a work than a pen does.

Revision, by definition, involves "re-visioning" or "re-seeing" a text from an outside perspective (Flower, 1979; Elbow, 1981; Sommers, 1982). The word processor, by its nature, can provide more perspective for the writer than does the pen. Consider the difference in the revision processes of our handwriting and computer classes. The students in the class using paper composed an original draft by hand. A week later they received that draft, now with a teacher's comments upon it. The students then may or may not have done some writing on that draft--in the margins or between lines--and then wrote out a clean copy by hand. In front of the students on their desks, finally, were two pages--a marked up copy and a clean revision to be submitted.

The computer groups underwent an essentially different revision

experience. After they composed upon the computer, they received a typed version of their text from the printer. One could argue that the typed draft alone provided a greater distance between the writer and text than a handwritten draft would. However, on the word processor the distance between writer and text increases as the process continues. After the typed version was returned a week later with comments, the computer students may or may not have done some writing on that draft--in the margins or between lines. Then they "called up" the original text on the screen. At that point they had two perspectives: the marked-typed copy and the "original" copy on the computer screen. With these two perspectives on their ideas, they could rethink the changes they had decided on as well as devise new changes while they pondered the clean copy of the original text. The fact that the original text was on a vertical electronic screen and not on a horizontal page made it different in nature from the marked page before the students. As Haas and Hayes (1986) have shown, the screen is different and in most cases harder to read than a page of paper. We think that--if not in the composing process at least in the revising process--such a difference in a text could be influential. The screen provides an increased distance, an "otherness" in the original text which might give the writer at the computer one additional perspective the writer on paper lacks.

Conclusion

In conclusion, revising on the word processor in a writing laboratory seems to have produced a significant effect on the overall

quality of revision. We attribute such a difference to several possible factors--student attitude, the influence of environment, and the difference in the revision process as it occurs on the word processor. The fluidity of the revision process on the computer and the extra outside perspective provided by the screen could have contributed to high overall quality of revisions performed on the word processor. Further research, concentrating on the order in which writers make changes on the computer screen, the permanence of such changes, and the role of the screen itself should help determine the effect of each of these factors on the revision process and on the quality of revisions performed on the word processor.

References

Balkena, S. (1984). The composing activities of computer literate writers. Dissertation Abstracts International, 45, 12A.

Butler-Nalin, K. (1985). Process and product: how research method and composing using computer influence writing. Dissertation Abstracts International, 46, 08A.

Case, D. (1985). Processing professorial words: personal computers and the writing habits of university professors. College Composition and Communication, 36, 317-22.

Catano, J. (1985). Computer-based writing: navigating the fluid text. College Composition and Communication, 36, 309-317.

Collier, R. (1983). The word processor and revision strategies. College Composition and Communication, 34, 149-155.

Daiute, C. (1986). Physical and cognitive factors in revising: insights from studies with computers. Research in the Teaching of English, 20, 141-59.

Daiute, C. & Taylor, R. (1981). Computers and the improvement of writing. Proceedings of the Association of Computing Machinery (pp. 83-88). Los Angeles: Association of Computing Machinery.

Duling, R. (1985). Word processors and student writing: a study of their impact on revision, fluency, and quality of writing. Dissertation Abstracts International, 46, 07A.

Elbow, P. (1981). Writing with Power: Techniques for Mastering the Writing Process. New York: Oxford University Press.

Faigley, L. & Witte, S. (1981). Analyzing revision. College Composition and Communication, 32, 400-414.

Flinn, J. (1985). Composing, computers and contexts: case studies of revision among sixth graders in national writing project classrooms. Dissertation Abstracts International, 46, 12A.

Flower, L. (1979). Writer-based prose: a cognitive process theory of writing. College English, 41, 19-37.

Flower, L. & Hayes, J. (1981). A cognitive process theory of writing. College Composition and Communication, 27, 365-387.

Gould, J. (1981). Composing letters with computer-based text editors. Human Factors 23, 593-606.

Greenland, L. (1985). The effect of microcomputers on writing ability and attitude toward business communications classes. Dissertation Abstracts International, 46, 08A.

Haas, C. & Hayes, J. (1986). Pen and paper vs. the machine: writers composing in hard copy and computer conditions. CTC Technical Report no. 18.

Harris, J. (1985). Student writers and word processing: a preliminary evaluation. College Composition and Communication, 36, 323-30.

Hawisher, G. (1986). The effects of word processing on the revision strategies of college students. Paper delivered at 1986 Conference on College Composition and Communication, New Orleans.

Koenig, J. (1984). Enhancement of middle school students' written production through the use of word processing. Dissertation Abstracts International, 45, 09A.

Miller, S. (1984). Plugging your pencil into the wall: an investigation of

word processing and writing skills at the middle school level. Dissertation Abstracts International, 45, 12A.

Nichols, R. (1984). The effects of computer-assisted writing on the composing processes of basic writers. Dissertation Abstracts International, 45, 08A.

Piper, K. (1984). An investigation of the effects of sentence combining and story expansion delivered by word processing microcomputers on the writing ability of sixth graders. Dissertation Abstracts International, 45, 09A.

Pivarnick, B. (1985). The effect of training in word processing on the writing quality of eleventh grade students. Dissertation Abstracts International, 46, 07A.

Pollock, S. (1985). Exploratory study of the use of the computer for revision to improve student writing. Dissertation Abstracts International, 46, 09A.

Rodrigues, D. (1985). Computers and basic writers. College Composition and Communication, 35, 336-339.

Sommers, N. (1982). Responding to student writing. College Composition and Communication, 29, 148-156.

Sudol, R. (1985). Applied word processing: notes on authority, responsibility, and revision in a workshop model. College Composition and Communication, 36, 331-336.

Table 1: Experimental Design

Class	Fall	Spring
Teacher #1	Once every 2 weeks	Twice a week in class
Teacher #2	Once every 2 weeks	Once a week outside class
Teacher #3	Once every 2 weeks	None

Table 2: Mean Improvement Scores (Revision over Original) as a Function of Semester and Computer Usage

Class	Fall	Spring
Teacher #1	.15	.46 (Twice a week in class)
Teacher #2	.21	.54 (Once a week outside class)
Teacher #3	.29	.27 (No computer usage)

Note. Scores are based on subtracting the grade on the original paper (low of 1 and high of 4) from the grade on the revision (low of 1 and high of 4). Thus, the higher the number, the greater the improvement of the revision over the original.